Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

however, to analyze the situation—to determine what is data for inference and what isn't. This analysis involves discriminative resolution of what seem to be wholes into more ultimate simples. The resources of experimentation, all sorts of microscopic and telescopic and registering apparatus, are called in to perform that analysis. As a result we differentiate not merely visual data from auditory—a discrimination effected by experiments within the reach of everybody—but institute discriminations of vast multitude of visual and auditory data. Physics and physiology and anatomy all play a part in the analysis. We even carry the analysis to the point of regarding say a color as a self-included object unreferred to any other object. We may avoid false inference by conceiving it not as a quality of any object, but as a product of a nervous stimulation and reaction. That is, instead of referring it to a ribbon or piece of paper we may refer it to the organism. But all this is only a part of the technique of suspended inference. We avoid some habitual inference in order in the end to make a more careful inference.

Thus we escape, by a straightening out of our logic (by avoiding erecting a system of logical distinctions and checks into a mythological natural history), the epistemological problems. We also avoid the contradiction which haunts every epistemological scheme so far propounded. As matter of fact every proposition regarding what is "given" to sensation or perception is dependent upon the assumption of a vast amount of scientific knowledge which is the result of a multitude of prior analyses, verifications, and inferences. What a combination of Tantalus and Sisyphus we get when we fancy that we have cleared the slate of all these material implications, fancy that we have really started with simple and independent givens, and then try to show how from these original givens we can arrive at the very knowledge which we have all the time employed in the determination of the simple sense data!

JOHN DEWEY.

COLUMBIA UNIVERSITY.

INTROSPECTION AS A BIOLOGICAL METHOD

IN reading Professor Woodbridge's stimulating article on the Belief in Sensations,[1] I have been impressed by the fact that the conclusion to which he was led, namely, that sensations are not elements of consciousness in any intelligible sense, finds strong support from the neurological side in the difficulty of finding any cortical mechanism for performing such functions as the doctrine of simple sensations implies. It is true that biology can not as yet formulate a general schema of the mechanism of consciousness; the same holds true for many of the so-called physiological functions, about which, however, we profess to have acquired a large body of scientific truth. Neurological research has, moreover, yielded many facts which may at least serve to limit the field of future inquiry in this field.

---

[1] Woodbridge, Frederick J. E., "The Belief in Sensations," this JOURNAL, Vol. X., pages 599–608.

I have recently endeavored to show[2] that there is no neurological mechanism by which simple sensory impulses can reach the cerebral cortex. There is no afferent tract leading into the cortex directly from a peripheral sense organ or from any center within the brain which is "pure," that is, devoted to a single sensory function. On the other hand, every afferent nervous impulse on its way to the cortex is to some extent affected by its passage through the various subcortical correlation centers; that is, it carries a *quale* of central origin. And this same afferent impulse in its passage through the spinal cord and brain stem may, before reaching the cortex, discharge collateral impulses into the lower centers of reflex coordination, from which incipient (or even actually consummated) motor responses are discharged previous to the cortical reaction. These motor discharges may, through the "back-stroke" action, in turn exert an influence upon the slower cortical reaction.

The cortex must, therefore, be thought of as acting through the subcortical reflex mechanisms, not in their stead, and the raw materials of cortical activity are not simple sense data, but highly complex nervous processes which have been elaborated on the reflex or instinctive plane. The efferent cortical discharge must also act through these same reflex mechanisms, whose pattern is largely preformed and innate.

It is commonly believed that the higher conscious processes are related in some way to the cerebral cortex, and this belief rests on as secure a scientific basis as any other physiologically established relation. The essentials of cortical process seem to consist, not in putting raw sense data into relation with each other, but in integrating complex physiological functions which are already under way and directing them by inhibition, reinforcement, or otherwise in the light of the previous experience of the individual (physiological or psychological memory). Whether the cortical centers can initiate any process *de novo* and whether cortical associational activity can be long maintained apart from some sort of subcortical influence are open to question. But even if an affirmative answer be given to

[2] Herrick, C. Judson, "Some Reflections on the Origin and Significance of the Cerebral Cortex," *Journal of Animal Behavior*, Vol. III., pages 222–236.

these questions, it still remains true that the materials with which these processes work have been in last analysis derived from previous sensori-motor processes which have left structural or other vestiges in the cortex. In other words, the cortex is fundamentally an organ of control over various types of interaction between external (environmental) and internal (physiological) processes.

Neurologists who regard the cerebral cortex as in some sense the organ of consciousness will, therefore, support Professor Woodbridge in his contention that simple sensations can not be regarded as elements of consciousness. But when he asks further, "what the objects of consciousness as a matter of fact are," one is inclined to raise the question, Is the search for an "object of consciousness" the wisest road to take? Are not these "objects" (percepts, constructs, ejects, or what-not) themselves part of the conscious process? And should not our attention be directed to the entire process as process rather than to a search for any sort of static elements?

When I first read Professor Dewey's discussion of the reflex circuit[3] he seemed to me to be reasoning in a circle in more ways than one; but upon further reflection I have come to feel that some such cyclic relation as he develops for reflexes is also true on the physiological side for the conscious process, with the environment at one end of the diameter and the cerebral cortex at the other end. Psychologically also the subject and the "object" seem to stand in some such antithetical relation, neither having real existence apart from the other or apart from the total process.[4]

The complex processes involved in human speech exhibit the same cycle of mutually interacting central and peripheral processes. It is not uncommon to find authors who can not compose without the stimulus of the pencil between the fingers to start the cortical machinery of sentence formation, or public speakers whose thoughts refuse to flow in the seclusion of the study, but who think logically and speak fluently on the rostrum before an audience. The objects of thought are not present in the mind at the beginning of utterance, but they grow up within the situation as it develops.[5]

The neurone as a unit of cerebral structure has only a very limited value for certain restricted lines of inquiry. The significant units in neurology are the reflex circuits and other functional connections as tied up into working systems. I wonder if there are any psychological "elements" which have more than a similarly restricted value. The search for typical *processes* may not give us so simple analytical schemata, but simple schemata are sometimes false charts which lead to shipwreck.

---

[3] Dewey, J., "The Reflex Arc Concept in Psychology," *Psych. Rev.*, Vol. III., page 357.

[4] Herrick, C. Judson, "A Functional View of Nature as Seen by a Biologist," this JOURNAL, Vol. II., pages 428–438.

[5] Pillsbury, W. B., "The Mental Antecedents of Speech," this JOURNAL, Vol. XII., pages 116–127.

Simple psychological "elements," "objects of consciousness," and the like seem to have been the most cherished idols of the psychologist's faith. If these must be discarded, is everything psychological lost? So it appears to some. In Doctor Watson's recent book on "Behavior"[6] he cheerfully throws out the psychological babe with the bath of metaphysics in which it was so long immersed. In fact, he seems to regard the child as ailing, if not moribund, and to view the empty tub with equanimity.

Whatever may be one's theory of the relation between body and mind, there is no justification for the elimination of introspective data from a comprehensive scheme of things. Possibly the new psychology may learn to get along without consciousness; but biology can not do so, for it is evidently a real factor in at least the higher stages of evolutionary history, and this factor can not be ignored in natural science.

We see in civilized man an organism with an enormous cerebral cortex and with a complex individual culture and social organization which permit of accurate forecasts of future events and cooperative enterprises. Now, even if it should ultimately prove possible to reduce all of these activities to "language habits" or other simple sensori-motor elements (a highly improbable supposition), it still remains true that each individual in these communities has his own subjective experience.

These personal experiences are, in fact, very real things, and to neglect them or brush them to one side as irrelevant epiphenomena is a thoroughly unscientific procedure. They form an integral part of the behavior complex as we know it in ourselves, and that they play some real part in the behavior of other men as this is objectively manifest to us is generally recognized. These are matters of common experience, involving no subtleties of philosophical analysis or metaphysical acumen. We know in the same way that we know other scientifically established facts that changes in bodily state, such as fatigue and various intoxications, are related to definite types of mental process and that mental processes in turn may be similarly related to definite motor acts, such as the shudder of fright and the tears of pity. And I opine that if we were not enmeshed in the web of a mischievous metaphysical tradition which for centuries has darkened counsel by words without knowledge, we should find that the problems concerning the relation of mind and body offer no difficulties which are fundamentally different from those regarding the relation of any organ and its function, of any object and its properties.[7]

---

[6] Watson, John B., "Behavior: An Introduction to Comparative Psychology," New York, 1914.

We know no ultimates in science. We do not know the ultimate cause of chemical affinity or gravitation or the ultimate mechanism of a neuro-muscular reflex, and our ignorance of the way in which the association centers of the cerebral cortex operate during the solution of a mathematical problem is of precisely the same order of magnitude. But we do know that falling bodies obey the law of inverse squares, that reflexes follow stimulation in definite lawful patterns, and that the conscious processes are modifiable by various well-known physiological agents.

Such a frankly physiological hypothesis does not, of course, solve all of the problems of mind and body, but it is not contradicted by any scientific facts at present known, and the evidence on the scientific side for regarding consciousness as a function of bodily organization is of exactly the same sort as that for regarding muscular movement or nervous conduction as such a function. It is true that we are not at present able to write an equation of energy transformation with mental process on one side and calories on the other; but we were no better off regarding nervous conduction until Tashiro's recent demonstration of metabolism in nerve fibers.[8]

What may be the precise relation between consciousness and metabolism is, of course, just the problem which is not yet solved. But whether it shall prove that certain kinds of metabolism are manifested in consciousness, just as other forms are manifested objectively as temperature changes, or whether consciousness is some sort of allotropic property which may manifest itself also in the objective way as physicochemical energy transformation, the fact remains that conscious processes are biological realities which can not be ignored in a comprehensive scheme of things. And the biologist can see no reason why they should not be observed in the only way open to him, namely, by introspection.

The genesis and the earliest stages in the unfolding of the psychic life are lost in the haze of our ignorance of the subjective experience of lower organisms and of very young children. Whether there is some sort of consciousness inherent in all living substances, as some maintain, or whether consciousness, like some other functions (such as the ability to maintain a uniformly higher temperature than the environment, to build nests, and to suckle the young after birth), arose at some relatively late period in animal evolution, is at present a purely speculative question. We have not the data at hand for an answer. But it is from every standpoint highly probable that, whenever consciousness appeared, it came as a gradual development out of some preexisting type of function; for the doctrine of continuity of process in evolution is one of the corner-stones of modern biology, to which the current mutation hypotheses form only an apparent exception.

---

[7] Compare Elliot P. Frost, "Can Biology and Physiology Dispense with Consciousness?" *Psych. Rev.*, Vol. XIX., page 248: "Consciousness is a process in precisely the same sense that osmosis or alimentation is a process."

[8] Tashiro, S., "Carbon Dioxide Production from Nerve Fibers when Resting and when Stimulated; a Contribution to the Chemical Basis of Irritability," *Am. Jour. of Physiology,* Vol. XXXII., pages 107–136. Also, "On the Nature of the Nerve Impulse," *Proc. Nat. Acad. Sci.,* Vol. I., pages 110–114.

Furthermore, the analysis of the behavior of both lower animals and men speaks unequivocally in favor of regarding consciousness as a positive biological factor in animal evolution, and not as a mere epiphenomenon without causal significance. The series of physicochemical phenomena in vital processes seems, when analyzed from the physiological standpoint alone, an unbroken closed system of causes and results. Nevertheless, when the widest possible view of the phenomena is taken, it is seen that in human communities, where consciousness is unquestionably present as a factor in the behavior complex, the objective vital manifestations are clearly different from those of the animal or plant communities in which consciousness is believed to be reduced or absent. The criteria of biological efficiency as this is manifested in human communities are far too complex to be analyzed by any physico-chemical standards now at our command; but when these phenomena in their aggregate are measured by the standard of biological efficiency, it is evident that consciousness here is a real factor.

We know that certain complex activities of the human nervous system may have a twofold manifestation: (1) As relatively simple and measurable physicochemical processes (such as the elimination of CO_2 and the generation of heat); and (2) as subjective experience. And the biological phenomena, when considered in all their aspects, suggest that the latter are as real causative factors in modifying behavior as the generation of heat by muscular work is a cause of an increase in the secretion of perspiration.

The fact that we have no means at our disposal for measuring directly the action of consciousness in terms of energy transformation is no proof that such action does not exist. Let us consider two men who are engaged upon their daily work. One is a laborer turning a windlass for hoisting rock out of a pit for the foundation of a bridge pier; the other is an engineer designing and computing specifications for the steel superstructure to be built upon the finished pier. If the work of each of these men be measured in the ordinary calorimeter apparatus, it will doubtless be shown that the body of the laborer has expended far more energy than that of the engineer. Nevertheless, when the entire causal sequence is studied, it is evident that the steel bridge can not be erected without the work of the engineer any more than the pit can be dug without the work of the laborer. The causal sequence is as direct and simple in the one case as in the other. It is conceivable that an energy equation might be written in both cases; but the calorimeter can give us a very small part of the total equation in either case, though certainly a larger proportion of the whole in the case of the laborer than in that of the engineer. For upon the engineer and others of the class whom we are wont to call "the intellectuals" the whole burden of the advancement of civilization rests. And it must not be forgotten in this connection that the advancement of human civilization is a biological phenomenon. However necessary it may be to detach special parts of this complex for separate scientific treatment (as in anthropology, ethnology, sociology, psychology, and the like), we err if we do not at the end of our analysis keep in mind the fundamental unity of biological process throughout the whole.

So far as the facts now in hand show, the outstanding differences between a bee-hive, a tribe of savages, and a civilized community can be resolved into differences in the ratio of intelligent to non-intelligent activity in their behavior. The student of animal behavior is, of course, fully justified in leaving consciousness out of account in his study of animal communities and carrying his analysis of objective factors in behavior to its limit. That is the technique of his specialty, and that it is a useful technique has been abundantly shown. But can he rest content with this? Is there not abundant scientific justification for including consciousness as introspectively known among the factors of human behavior (and inferentially of the behavior of some other animals also)? That the data of introspection must be more critically used than has sometimes been done in the past is freely granted, and whether in any given programme of research it is expedient to use these data is a quite different question which must be decided on its own merits in each case.

Professor Pillsbury has recently said,[9] "It is possible to neglect behavior in the study of consciousness, but not to neglect consciousness in the study of behavior." From our present point of view it would seem of doubtful expediency to draw any methodological distinction of this sort between these departments of study. It is a legitimate scientific procedure to isolate for experimental purposes any phenomena from their setting, provided that in the end the cor-

[9] Pillsbury, W. B., "The Function and Test of Definition and Method in Psychology," *Science*, N. S., Vol. XLI., pages 371–380.

responding synthesis is effected. Recent students of animal behavior have shown that much can be gained by ignoring introspective data as far as possible and adhering rigidly to the objective method of investigation. That a very promising field for the study of human behavior is here open is equally evident. But it does not follow that because this method works well in the study of rats and guinea-pigs and of some human activities, therefore introspection under suitable control is a waste of effort. We conclude, then, that, while it is possible and legitimate to neglect consciousness in any particular programme of the study of behavior, it is both inexpedient and unscientific to eliminate the introspective method from the behaviorist's programme as a whole.

On the other hand, it is equally mischievous to assume that because certain useful generalizations can be drawn from a purely introspective study of consciousness, therefore behavior can be neglected in the psychologist's programme as a whole. We have had several centuries of study of this sort of "pure psychology" with results which are generally regarded as unsatisfactorily meager. We are, accordingly, somewhat surprised to see one of the leaders of the new school of animal behavior in America writing an "Introduction to Psychology"[10] whose "sole purpose" is "to aid beginning students in the study of pure psychology," that is, of consciousness as such, quite apart from any bodily or other processes. This is confessedly a pedagogic device, for Professor Yerkes is careful to explain that there is a science of physiological psychology which his pupils may later have an opportunity to discover.

In a special research it is legitimate to use either the introspective or the objective method alone, as Doctor Yerkes has ably illustrated by his own work; but to a layman (who has, however, had considerable experience in teaching other scientific subjects) it would seem that the beginning student in psychology should be given an opportunity to see his science in its setting rather than as a completely detached discipline. In our medical schools we teach anatomy and physiology in separate laboratories and by different instructors, for reasons of practical convenience. But we require the student to study both subjects and we expect him to synthesize the courses so as to know the human body as a working machine. He sometimes fails to effect the synthesis, in which case we regard his courses in both subjects as valueless, no matter how letter-perfect he may be in the content of each taken by itself.

The details of the structure of the nervous system may be out of place in an elementary course in psychology, but the recognition of the fact that there is a functional relationship between the conscious life and other vital processes is the foundation upon which alone a symmetrical superstructure can be built; and the sooner this can be impressed upon the beginning student the better for him and for the future of science.

---

[10] Yerkes, Robert M., "Introduction to Psychology," New York, 1911.

The naïve mind has no interest in an "object" apart from its place in the general scheme of things. He asks, What is it for? How does it work? Science has at last caught up with this childlike attitude. By long and painful labor of many centuries we have come to see that purely descriptive studies are not science. We do not in science study bodies apart from their functions, nor disembodied functions. If psychology is to maintain its place among the sciences, it must not isolate itself from the rest of natural process by limiting its interest to pure introspection or to purely objective behavior.[11]

C. JUDSON HERRICK.

THE UNIVERSITY OF CHICAGO.

GREGARIOUSNESS AND THE IMPULSE TO CLASSIFY

WHAT I take to be one of the psychical expressions of that trait so marked in simian species, gregariousness, has recently been termed in ethnological circles the sense of participation, the feeling of being oneself related to what comes into consciousness. This mystical feeling is accompanied, we know, by ideas and impulses which give rise to many forms of conduct and many trains of theory. Magic and religion have hitherto yielded us the most obvious[1] and abundant illustrations of this aspect of mentality. Take the theory and practises of magical contagion, or in religion, the belief in possession and its ritual. For the moment, however, I would indicate how the sense of participation manifests itself in that part of the social organization we sometimes call status, the social categories.

These social categories may be summed up as the categories of age, sex, kin, caste, place-fellowship, friendship. Within the groups which this social differentiation establishes the gregarious instinct is concentrated, to them the sense of participation attaches, around them institutional life revolves, and into them every individual in so far as he is a member of society must fit. Anomalies do, of course, occur, but they are considered unsocial or anti-social,—nuisances or laughing-stocks, perverts, criminals, illegitimates, traitors.

---

[11] Since writing these lines my attention has been called to Professor Angell's very judicious analysis of this problem, "Behavior as a Category in Psychology," *Psych. Rev.*, Vol. XX., pages 255–270.

[1] The most obvious, because in supernaturalism we have secured a certain degree of that detachment or immunity from the sense of participation which makes rationalism possible.